

IV. *A new Case in Squinting*, by Erasmus Darwin,
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F. R. S.

Litchfield, March 10, 1777.

Read Jan. 15, 1777. **T**HE following case in squinting, as a similar one has not been recorded or explained by others, may perhaps merit your attention from its novelty.

About six years ago I was desired to see a child of the reverend Dr. SANDFORD, in Shropshire, to determine if any method could be devised to cure him of squinting. The child was then about five years old, and exceedingly tractable and sensible, which enabled me to make the following observations upon him with great accuracy and frequent repetition.

1. He viewed every object which was presented to him with but one eye at a time.
2. If the object was presented on his right-side, he viewed it with his left eye; and if it was presented on his left-side, he viewed it with his right eye.
3. He turned the pupil of that eye, which was on the same side with the object, in such a direction that the
image

image of the object might fall on that part of the bottom of the eye where the optic nerve enters it.

4. When an object was held directly before him, he turned his head a little to one side, and observed it with but one eye, *viz.* with that most distant from the object, turning away the other in the manner above described; and when he became tired with observing it with that eye, he turned his head the contrary way, and observed it with the other eye alone, with equal facility; but never turned the axes of both eyes on it at the same time.

5. He saw letters, which were written on bits of paper, so as to name them with equal ease, and at equal distances, with one eye as with the other.

6. There was no perceptible difference in the diameters of the irises, nor in the contractibility of them, after having covered his eyes from the light. These observations were carefully made by writing single letters on shreds of paper, and laying wagers with the child that he could not read them when they were presented at certain distances and directions.

From these circumstances it appeared, that there was no defect in either eye, which is the common cause of squinting, so well observed by M. BUFFON and Dr. REID; and hence, that the disease was simply a depraved habit of moving his eyes, and might probably be occasioned
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by the form of a cap or head-dress, which might have been too prominent on the sides of his face, like bluffs used on coach-horses; and might thence, in early infancy, have made it more convenient for the child to view objects placed obliquely with the opposite eye, till by habit the *musculi adductores* were become stronger, and more ready for motion than their antagonists.

A paper gnomon was made, and fixed to a cap; and when this artificial nose was placed over his real nose, so as to project an inch between his eyes, the child, rather than turn his head so far to look at oblique objects, immediately began to view them with that eye which was next to them. But the death of Dr. SANDFORD, which happened soon after, occasioned the removal of his family; and the grief and cares of Mrs. SANDFORD prevented this, and the other methods proposed, from being put in execution.

About a month ago I had again an opportunity of seeing master D. SANDFORD, and observed all the circumstances of his mode of vision to be exactly as they were six years before, except that they seemed established by longer habit; so that I could not by any means induce him to bend the axes of both his eyes on the same object, not even for a moment.

A gnomon

A gnomon of thin brass was made to stand over his nose, with a half circle of the same metal to go round his temples; these were covered with black silk, and by means of a buckle behind his head, and a cross-piece over the crown of his head, this gnomon was managed so as to be worn without any inconvenience, and projected before his nose about two inches and an half. By the use of this gnomon he soon found it less inconvenient to view all oblique objects with the eye next to them, instead of the eye opposite to them.

After this habit was weakened by a week's use of the gnomon, two bits of wood, about the size of a goose-quill, were blackened all but a quarter of an inch at their summits; these were frequently presented for him to look at, one being held on one side the extremity of his black gnomon, and the other on the other side of it. As he viewed these they were gradually brought forwards beyond the gnomon, and then one was concealed behind the other: by these means, in another week, he could bend both his eyes on the same object for half a minute together.

By the practice of this exercise before a glass, almost every hour in the day, he became in another week able to read for a minute together with his eyes both directed on the same objects; and I have no doubt, if he has pa-

tience enough to persevere in these efforts, but he will in the course of some months overcome this unfightly habit.

I shall conclude the account of this case by adding, that all the other squinting people I have had occasion to attend to, have had one eye much less perfect than the other, according to the observations of Mr. BUFFON and Dr. REID. These patients, where the diseased eye is not too bad, are certainly curable by covering the best eye many hours in a day; as, by a more frequent use of the weak eye, it not only acquires a habit of turning to the objects which the patient wishes to see, but gains at the same time a more distinct vision; and the better eye at the same time seems to lose somewhat in both these respects, which also facilitates the cure.

This evinces the absurdity of the practice of prohibiting those who have weak eyes from using them; since the eye, as well as every other part of the body, acquires strength from that degree of exercise which is not accompanied with pain or fatigue; and I am induced to believe, that the most general cause of squinting in children originates from the custom of covering the weak eye, which has been diseased by any accidental cause, before the habit of observing objects with both eyes was perfectly established.

The facility with which master SANDFORD received the images of oblique objects on the insensible part of the retina of one eye, whilst he viewed them with the other, induced me to observe the size of this insensible spot, and to endeavour to ascertain the cause of it.

There was formerly a dispute among philosophers, whether the choroid coat of the eye or the retina was the immediate organ of vision, which has lately been revived in some measure in Dr. PRIESTLEY's valuable History of Light and Colours; and it was then thought by one party in this dispute, that the defect of the choroid coat, where the optic nerve enters the eye, was the cause of this want of vision in that part.

But the following observation shews beyond a doubt the fallacy of this supposition: the diameter of the optic nerve, at its entrance into the eye, is about one-sixth of an inch, and the perforation of the choroid coat, through which it passes, must of necessity be of the same diameter: now the dark spot, which is seen in objects opposed to the center of the optic nerve, if it was occasioned by the deficiency of the choroid coat, should, at nine inches distance from the eye, be fifty-four times the diameter of this aperture, or nine inches in diameter; whereas I find, by experiment, that a paper of one inch in diameter could not be totally concealed at nine inches distance

from my eye; and M. LE CAT by accurate observations found, that the insensible part of his eye was but between the thirtieth and fortieth part of an inch in diameter. This experiment is so easily made, that it can be attended with no fallacy; and at the same time that it shews that the insensible spot, where the optic nerve enters the eye, is not owing to the deficiency of the choroid coat, intirely subverts the opinion of the choroid coat being the organ of vision; for vision exists where the choroid coat is not.

Nor is the insensibility of the center of the optic nerve owing to the ingress of the arteries along with it into the eye; for a large branch of this artery runs along the bottom of the eye, where vision is most distinct, and because all this artery is covered with the expanse of the retina on the external side of it. Mr. SAVAGE made an experiment for another purpose, which however shews, that the optic artery, where it is branched under or through the retina, does not much disturb the power of vision. It is this: if you look on a white wall on a luminous day, with the Sun shining on the wall only by its reflected light, you will discern the parts of the wall become darker and lighter at every pulsation of the optic artery. This darker and lighter appearance is like net-work, and not uniform like the wall itself; but the

the whole, though rather darker while the diastole of the artery compresses the retina, is yet distinctly visible.

The following circumstance seems to give rise to the insensibility of the central part of the optic nerve at its ingress into the eye, which I have observed in several calves' eyes. The point of a pair of scissors was introduced behind the ciliary circle, and the whole of the cornea, aqueous humour, iris, and crystalline, being removed, the retina was beautifully seen through the vitreous humour somewhat magnified. On exposing this to the sun-shine, and inspecting it with nicety, a white filament, about the tenth of an inch in length, arising from the center of the optic nerve, was seen ascending straight upwards into the vitreous humour, like a thin white worm. The use of this may be to supply the vitreous humour or crystalline with nourishment, whether it be a nerve or an empty blood-vessel; but this is certain, that its rising so high above the surface of the retina must render it incapable of vision: whence there is just reason to conclude, that this conformation must be the true cause of the insensibility of this part of the eye.

I do not affirm, that the human eye, either during infancy or in our riper years, is similar in conformation to that of a calf, nor have we sufficient opportunities to ob-

serve them; but I suspect this vessel may, after the growth of the animal, be totally obliterated; and that, in some few instances, the optic nerve may even in this part become sensible to light. One instance I am certain I have seen, as it was in a man capable of the most patient and accurate observation, who on numberless repeated trials, at different times, in my presence, could never lose sight of the smallest object with either of his eyes.

Supplement to the case in squinting.

IT since occurred to me, that the unusual mode of squinting described in the above paper must have arisen from some original difference in the sensibility of some parts of the eye, which might have rendered it more easy for master SANDFORD, when a child, to observe objects with one eye only, and that with the eye most distant from objects presented obliquely to him.

Two circular papers, each of four inches diameter, were stuck against the wall, their centers being exactly at eight inches distance from each other. On closing one eye, and viewing the central spot of one of these papers with the eye furthest from it, and then retreating
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Twenty-six inches from it, the other paper became invisible. This experiment was made on five people of various ages, from ten years old to forty; and the paper disappeared to them all at about this distance, or an inch or two more or less: but to master SANDFORD the paper disappeared at about thirteen inches distance from the wall. These papers were afterwards removed to twelve inches, and then to four inches interval between them; and by the nicest observations on repeated trials I found, that the paper, equally with one eye as with the other, uniformly disappeared to him at about half the distance it did to five others.

Another curious circumstance is, that as large a paper disappeared to him at half the distance as it did to others at the whole distance; and hence the insensible part of the center of the optic nerve in his eyes is, as near as can be estimated, four times the area of the insensible part of the eyes of other people, at the same time that the angle made between the ingress of the optic nerve and the bottom of the eye is twice as great as in others.

It is easy to conceive that, in early infancy, when any object which the child wished to inspect was presented obliquely to him, that on this first indistinct view of it, before either eye could be turned towards it, it would appear much more brilliant and distinct to the contrary eye,

eye, than to that nearest the object, as so great a part of it would now fall on the large insensible part of that eye. This must naturally induce him to view it with the opposite eye, to which it already appeared more brilliant and distinct: and this to him would be so much easier to accomplish, as the insensible part of the neglected eye was great enough to receive as large a part of an object as is usually viewed at once with accuracy, and hence would not confuse the vision of the other.

I must beg leave to add, that by wearing the artificial nose he has greatly corrected the habit of viewing objects with the eye furthest from them; and has more and more acquired the voluntary power of directing both his eyes to the same object, particularly if the object be not more than four or five feet from him; and will, I believe, by resolute perseverance, intirely correct this unsightly deformity. Nothing but the curiosity and novelty of the subject can excuse the length of this paper.

